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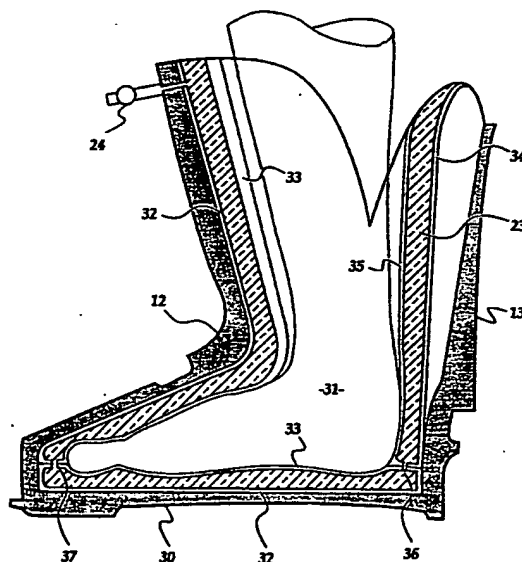
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Published

With international search report.

(54) Title: FOOTWEAR ASSEMBLY



(57) Abstract

A shoe or boot has an adjustable outer (12, 13, 30), a flexible chamber (23) for supporting a foot (31) within the outer and containing particulate material in the form of resilient beads, and an exhaust valve (24) for exhausting air from the chamber to form a substantially rigid mould of the foot within the boot.

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"FOOTWEAR ASSEMBLY"**TECHNICAL FIELD**

This invention relates to a footwear assembly.

5 The invention has particular application to a footwear assembly having an adjustable liner for closely conforming to the unique footshape of an individual wearer. The invention is of particular relevance to ski boots and particular reference will be made to such an application. However the invention is applicable to other sporting shoes
10 such as running shoes, basketball boots, roller blades, hiking boots etc, and it will be understood that the invention is applicable to all footwear, including orthotic footwear.

BACKGROUND ART

15 Ski boots are known to utilise support/cushioning means for cushioning the user's foot from the rigid inner surface of the boot casing. Orthotic footwear is also well known and patient-specific orthotic inserts are provided for podiatric treatment. It is thus well known to shape
20 support/cushioning means to conform to the footshape of an individual user, however known systems are not simple to operate and can also require specialist orthotic assistance to establish user-specific cushioning means conforming to the unique footshape of an individual. Moreover, once
25 established, known support/cushioning means cannot be reshaped to conform to the unique footshapes of different individuals or to allow for the fact that the footshape of one person varies with age, time, temperature and in accordance with other factors.

30 DISCLOSURE OF THE INVENTION

The present invention aims to provide a footwear assembly which will be reliable and efficient in use.

This invention in one aspect resides broadly in a

footwear assembly including:-

an adjustable outer boot or shoe, and

support means for supporting a foot as hereinafter defined within the outer boot or shoe, the support means
5 including at least one flexible chamber containing particulate material.

As used herein, the expression "foot" can include the ankle and the lower leg.

It is preferred that the assembly includes an exhaust
10 valve for the exhaust of fluid from the chamber.

The flexible chamber can be of any suitable shape and manner of construction as is suitable for providing a cushioning layer between a foot and the outer boot or shoe, and can be a bag-like chamber or a bladder. It is
15 preferred that the chamber includes an outer lining adapted to substantially juxtapose the inner surfaces of the outer boot or shoe and an inner lining adapted to substantially juxtapose the surface of a foot when positioned within the outer boot or shoe.

The chamber may extend to substantially surround a foot but it is preferred that the assembly includes a lower flexible chamber adapted to support the sole of the foot within the outer boot or shoe. In a preferred embodiment the assembly includes at least one upper flexible chamber
20 adapted to support other surfaces of the foot within the outer boot or shoe. The chambers may be independent of each other with each including an exhaust valve. Alternatively the chambers can be in fluid communication whereby fluid from each the chamber is exhaustible through
25 the exhaust valve.

The chambers may each contain only one compartment, but preferably at least the upper chambers include a plurality of baffles between the outer and inner linings to form a plurality of discrete compartments therein.
30 Preferably the compartments are in fluid communication and contain particulate material.

In a preferred embodiment the baffles are inclined to the outer and inner linings. The baffles may comprise a single membrane or alternatively the baffles may comprise a membrane looped from one of the outer or inner linings to the other lining and back to constitute an envelope. Preferably the envelopes contain particulate material.

The footwear assembly may also include an inner foot enclosure adapted to fit within the outer boot or shoe, the outer surface of the inner foot enclosure constituting the outer lining. Preferably the footwear assembly also includes cushioning means adjacent the inner lining and constituting an inner surface of the inner foot enclosure.

Fluid may be exhausted from the chamber or chambers by applying a pumping action or a vacuum source or suction to the exhaust valve. In one embodiment the assembly includes pump means for exhausting fluid from the chamber. The pump may be built in or otherwise attached or affixed to the outer boot or shoe.

In the preferred embodiment the fluid is air, the pump means is a vacuum pump, the valve is a two-way valve and the chamber freely communicates with the atmosphere in one position of the two-way valve. Alternatively in an embodiment not illustrated, the assembly may include reservoir means forming a closed fluid system with the chamber, the exhaust valve is a two-way valve, and the pump means is operable to transfer fluid between the chamber and the reservoir in accordance with the condition of the two-way valve.

The particulate material can be any suitable small and preferably uniform grained material. Sand, grain husks or grain such as rice etc can be used. However it is preferred that the particulate material comprises resilient pellets. The resilient pellets may be polystyrene beads or the like. Alternatively the resilient pellets may be encapsulations of a shock-absorbent gaseous fluid, liquid or gel-like substance.

In another aspect this invention resides broadly in a ski boot including:-

an adjustable outer casing, and
an inner boot assembly within the casing;

5 wherein

the inner boot assembly includes an outer surface adapted to substantially juxtapose the inner surface of the casing, an inner surface adapted to substantially juxtapose the surface of a foot as hereinbefore defined when the foot
10 is positioned within the inner boot assembly, and support means located between the outer and inner surfaces, the support means including at least one flexible chamber containing particulate material.

It is preferred that the ski boot includes an exhaust
15 valve for the exhaust of fluid from the chamber.

In a further aspect this invention resides broadly in a method of supporting a foot as hereinbefore defined in footwear, the method including:-

providing a footwear assembly having an adjustable
20 outer boot or shoe and support means within the outer boot or shoe, the support means including at least one flexible chamber containing fluid and particulate material;

positioning a foot within the support means;
removing substantially all fluid from the chamber, and
25 tightening the outer boot or shoe about the support means.

DESCRIPTION OF PREFERRED EMBODIMENT

In order that this invention may be more easily understood and put into practical effect, reference will
30 now be made to the accompanying drawings which illustrate a preferred embodiment of the invention, wherein:-

FIGS 1 and 2 are perspective views of a ski boot in accordance with the invention with the heel piece respectively closed and open;

35 FIG 3 is a side view of the ski boot of FIG 2;

FIGS 4 and 5 are respectively an exploded perspective view and a side view of the inner boot and heel in accordance with the invention;

FIGS 6 and 7 illustrate a flexible chamber support in expanded and exhausted conditions respectively;

FIG 8 is a partial cross-sectional elevation through the wall of the inner boot;

FIG 9 is a cross sectional elevation of a ski boot in accordance with the invention;

FIGS 10 and 11 illustrate alternative baffle arrangements within a flexible chamber, and

FIGS 12 and 13 are cross-sectional elevations of a flexible chamber having a single membrane baffle and illustrate the disposition of the pellets in the chamber in the expanded and exhausted conditions respectively.

As can be seen in FIGS 1 to 3, a ski boot 11 has a fixed outer casing 12 incorporating a sole, toe, side, upper and tongue portions. Outer heel casing 13 is pivotally mounted to casing 12 about pivots 14. The outer casings are adjustable to tighten or loosen the fit of the ski boot about the foot by means of clamps 15, 16 and 17. Inner boot 18 and inner heel 19 fit closely within the outer casings and are seen in greater detail in FIGS 4 and 5.

Inner boot 18 is adapted to abut the sole, toes, sides, arch, ankle and shin of a user, and inner heel 19 is adapted to abut the user's heel, rear ankle and the lower back leg. As can be seen in dotted outline in FIG 5, inner boot 18 includes a sole support chamber 20, a pair of side support chambers 21 and a tongue support chamber 22. Inner heel 19 has a heel support chamber 23.

A two-way exhaust valve 24 is connected to the support chambers 20, 21 and 22. The heel support chamber 23 may also be connected to support chambers 20, 21 and 22 as illustrated or alternatively heel support chamber 23 can be exhausted through another exhaust valve (not illustrated).

FIGS 6 and 7 schematically illustrate the principle of operation of a support chamber in accordance with the invention. A flexible relatively flat sandwich-like bag 25 forms a support chamber 51 which is partially filled with particulate material 26. Support chamber 51 communicates with atmosphere through a valve 27 shown schematically open in FIG 6 and closed in FIG 7. If pressure is applied to support chamber 51 by an object being pressed into the support chamber with valve 27 open, air will be forced out of chamber 51 and the support chamber will form a complimentary or negative shape of the object.

If a vacuum pump is then applied to valve 27 and chamber 51 is evacuated whilst the object remains pressed into the support chamber, particulate material 26 will be compressed under the force of atmospheric pressure and form a rigid mass having a shape conforming with the object and the surface against which the support chamber bears. As can be seen in FIG 7, the upper surface of support chamber 51 has adopted the shape of the sole of the foot.

Particulate material 26 is preferably pellet-like or granular. It may be coarse grained sand and rice, lentils or other grains have been found to be suitable as has grain husks. It is preferable that the particulate material is light and resilient so that the boot or shoe is not heavy and incorporates shock absorbing properties. The type of expanded foam pellets used for bean bag fill has been found to be suitable. Alternatively the pellets can be shock absorbent beads or encapsulations of air, liquid or a gel. The pellets are preferably spherical and optionally have a diameter of between 1 and 3 millimeters.

The support chamber is made from a fluid proof or air proof material which is flexible and able to be thermally or chemically sealed. Vinyl, other plastics and rubber sheeting is suitable.

As can be seen in FIG 8, the wall of inner boot 18 and inner heel 19 is made of an outer stiffening lining 29

adapted to conform to and fit snugly within the outer casing of the ski boot. Stiffening lining 29 may be made from leather, plastics or other material suitable for retaining shape whilst being pliable enough to conform the shape of the inner boot to the interior of the outer casing. A support chamber as described above is sandwiched between stiffening lining 29 and an inner lining 28 which is adapted to fit snugly around the user's foot. Inner lining 28 may be a cloth covered layer of foam or other smooth cushioning material.

As can be seen in FIG 9 which is a cross sectional elevation through the ski boot illustrated in FIG 3, the ski boot has a fixed outer casing 12, sole 30 and outer heel casing 13 in which the inner boot and inner heel fit snugly. A user's foot 31 is shown within the ski boot and supported by sole support chamber 20, tongue support chamber 22 and heel support chamber 23. Side support chambers 21 are not seen in FIG 3. Sole support chamber 20 and tongue support chamber 22 are seen sandwiched between outer stiffening lining 32 and inner lining 33 of the inner boot, and heel support chamber 23 is seen sandwiched between outer stiffening lining 34 and inner lining 35 of the inner heel. Valve 24 is connected to tongue support chamber 22 and the support chambers are interconnected by ports 36 and 37 for evacuation through valve 24.

FIG 10 illustrates a single membrane baffle 38 between side walls 39 and 40 of a support chamber to form compartments 42 in the support chamber. Apertures 41 in baffle 38 allow for evacuation of air and allow air to flow between compartments so that during fitting foot movement can force air between compartments.

A double sided baffle 43 is illustrated in FIG 11 between side walls 44 and 45 and forms compartments 48 in the support chamber. Baffle 43 has apertures 46 to allow for the passage of air or other liquid as described above. Baffle 43 is formed by looping a single membrane from one

side wall back on itself to form an envelope or enclosure 47 and affixing an opposite side of the looped baffle to the other sidewall. Particulate material can be placed in envelope 47 as well as in compartments 48.

5 The baffles are disposed at an angle to the sidewalls and may be affixed adhesively or by thermal or chemical bonding. The apertures are sized to allow free passage of air therethrough but are smaller than the minimum dimension of the pellets to prevent migration of pellets between
10 compartments.

FIGS 12 and 13 illustrate the disposition of pellets in a flexible chamber having a single membrane baffle in the expanded and exhausted conditions respectively. In FIG 12 it can be seen that pellets partially fill compartments
15 49 to a level 50 above the lowermost point of connection of the upper baffle. Because the baffles are angled to the sidewalls as described above, particulate material will be disposed throughout the entire height of vertically aligned support chambers such as the sides, tongue, heel and upper
20 support chambers. In FIG 13 it is seen that upon compression the pellets completely fill compartments 49.

In use a user's foot is inserted in the inner boot and with the valve allowing free communication with the atmosphere, the foot is pushed with a massaging action
25 against the sole and the outer casing tightened as the foot is settled into the support. With the valve switched to exhaust setting, a pump is applied to the valve to exhaust air from the support chambers. Thus the support is first moulded to the shape of the foot and leg and then set in
30 the unique individual shape.

The footwear assembly in accordance with the invention will be seen to possess a number of advantages. It is particularly beneficial in ski boots in providing a uniquely tailored support for an individual skier. The
35 invention is simple to use and can be re-used allowing for hired ski boots to accommodate a range of users with the

same "personalised" fit as has hitherto been available in only high performance ski boots. Furthermore it is advantageous that the support can be remoulded to adapt to changes in foot shape of the same user as such changes occur from time to time. The footwear support is also advantageous in providing fine control during high performance skiing where firmly fitting boots are most desirable.

The footwear support of this invention provides a close fitting mould which is contoured to the particular shape of a user's foot and bears on the foot with uniform pressure thereby lessening the occurrence of pressure spots and decreasing the likelihood of blistering caused by movement of the foot within the boot or shoe.

The nature of the pellets can be varied to provide advantageous effects. Utilisation of relatively hard pellets can provide a stippled surface which is beneficial in stimulating blood circulation in a manner similar to that provided in spike-soled sandals. Utilisation of smaller pellets of shock-absorbing material can provide a relatively hard sole chamber having good shock-absorbing properties and reducing the likelihood of stress fractures for joggers and long-distance runners.

It will of course be realised that whilst the above has been given by way of an illustrative example of this invention, all such and other modifications and variations hereto, as would be apparent to persons skilled in the art, are deemed to fall within the broad scope and ambit of this invention as is hereinafter claimed.

CLAIMS

1. A footwear assembly including:-
an adjustable outer boot or shoe, and
support means for supporting a foot as hereinbefore
5 defined within said outer boot or shoe, said support means
including at least one flexible chamber containing
particulate material.
2. A footwear assembly as claimed in claim 1, wherein
10 said assembly includes an exhaust valve for the exhaust of
fluid from said chamber.
3. A footwear assembly as claimed in claim 2, wherein
said chamber includes an outer lining adapted to
substantially juxtapose the inner surfaces of said outer
boot or shoe and an inner lining adapted to substantially
15 juxtapose the surface of a foot when positioned within said
outer boot or shoe.
4. A footwear assembly as claimed in claim 3, wherein
said assembly includes a lower flexible chamber adapted to
support the sole of said foot within said outer boot or
20 shoe.
5. A footwear assembly as claimed in claim 4, wherein
said assembly includes at least one upper flexible chamber
adapted to support other surfaces of said foot within said
outer boot or shoe.
- 25 6. A footwear assembly as claimed in claim 5, wherein
said chambers are in fluid communication whereby fluid from
each said chamber is exhaustible through said exhaust
valve.
7. A footwear assembly as claimed in claim 6,

wherein at least said upper chambers include a plurality of baffles between said outer and inner linings to form a plurality of discrete compartments therein.

5 8. A footwear assembly as claimed in claim 7, wherein said baffles are inclined to said outer and inner linings.

9. A footwear assembly as claimed in claim 8, wherein said compartments are in fluid communication and contain particulate material.

10 10. A footwear assembly as claimed in claim 9, wherein said baffles comprise a membrane looped from one of said outer or inner linings to the other lining and back to constitute an envelope.

11. A footwear assembly as claimed in claim 10, wherein said envelopes contain particulate material.

15 12. A footwear assembly as claimed in claim 3, wherein said assembly includes an inner foot enclosure adapted to fit within said outer boot or shoe, the outer surface of said inner foot enclosure constituting said outer lining.

20 13. A footwear assembly as claimed in claim 12, wherein said assembly includes cushioning means adjacent said inner lining and constituting an inner surface of said inner foot enclosure.

25 14. A footwear assembly as claimed in claim 3, wherein said assembly includes pump means for exhausting fluid from chamber.

15. A footwear assembly as claimed in claim 14, wherein said fluid is air and said pump means is a vacuum pump.

16. A footwear assembly as claimed in claim 14, wherein said assembly includes reservoir means forming a closed fluid system with said chamber, said exhaust valve is a two-way valve, and said pump means is operable to transfer
5 fluid between said chamber and said reservoir in accordance with the condition of said two-way valve.

17. A footwear assembly as claimed in claim 3, wherein said particulate material comprises resilient pellets.

18. A footwear assembly as claimed in claim 17, wherein
10 said resilient pellets are polystyrene beads or the like.

19. A footwear assembly as claimed in claim 17, wherein said resilient pellets are encapsulations of a shock-absorbent gaseous fluid, liquid or gel-like substance.

20. A ski boot including:-
15 an adjustable outer casing, and
an inner boot assembly within said casing;
wherein

said inner boot assembly includes an outer surface adapted to substantially juxtapose the inner surface of
20 said casing, an inner surface adapted to substantially juxtapose the surface of a foot as hereinbefore defined when said foot is positioned within said inner boot assembly, and support means located between said outer and inner surfaces, said support means including at least one
25 flexible chamber containing particulate material.

21. A ski boot as claimed in claim 1, wherein said ski boot includes an exhaust valve for the exhaust of fluid from said chamber.

22. A method of supporting a foot as hereinbefore defined
30 in footwear, said method including:-

providing a footwear assembly having an adjustable outer boot or shoe and support means within said outer boot or shoe, said support means including at least one flexible chamber containing fluid and particulate material;

- 5 positioning a foot within said support means;
- removing substantially all said fluid from said chamber, and
- tightening said outer boot or shoe about said support means.

1/6

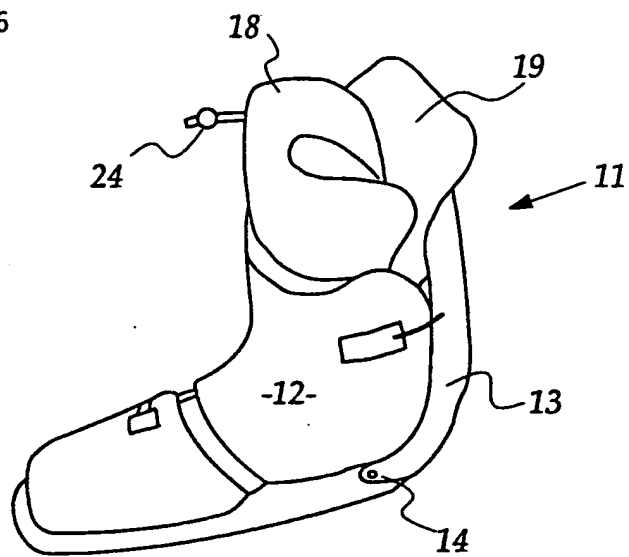


Figure 1.

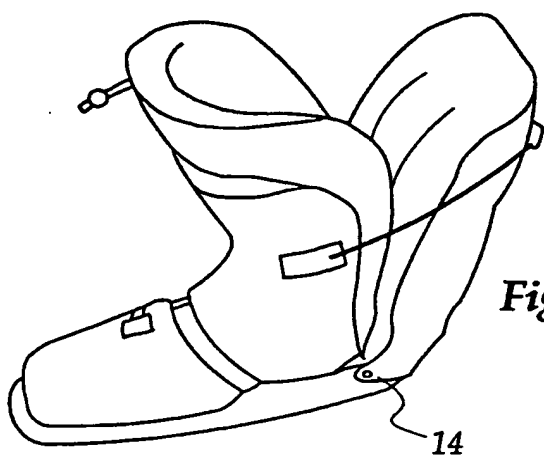


Figure 2.

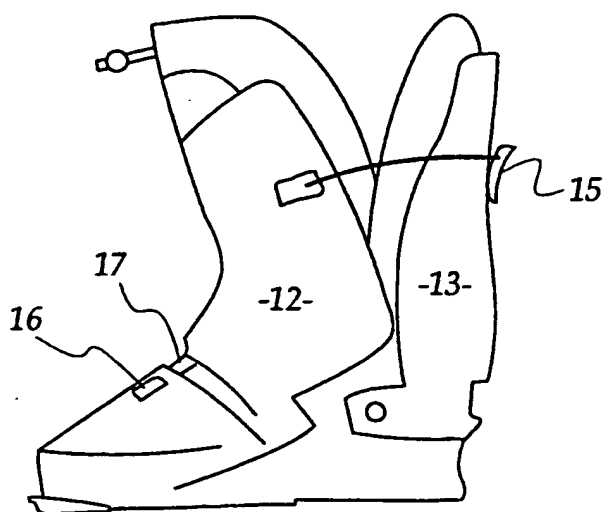


Figure 3.

SUBSTITUTE SHEET

2/6

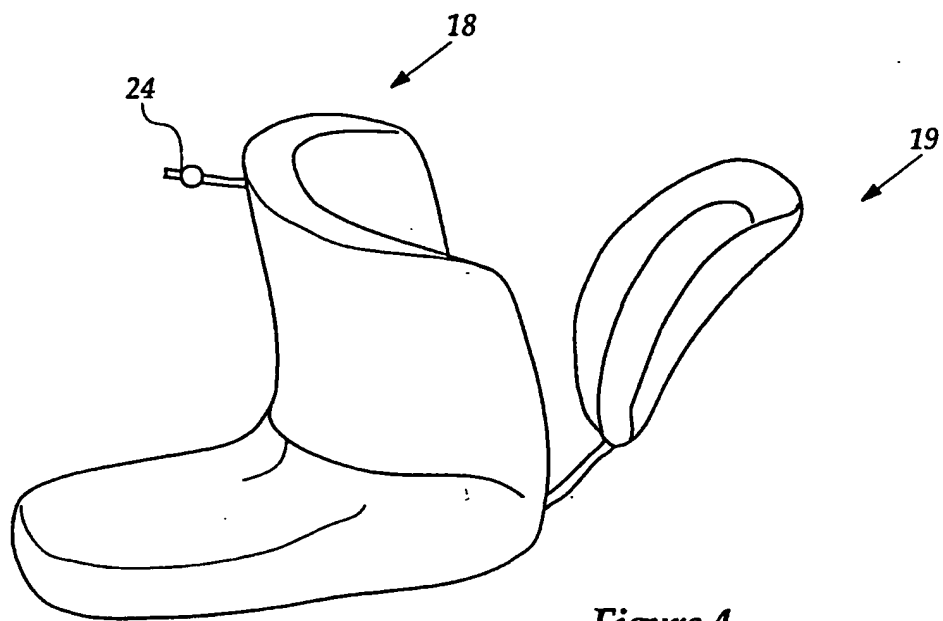


Figure 4.

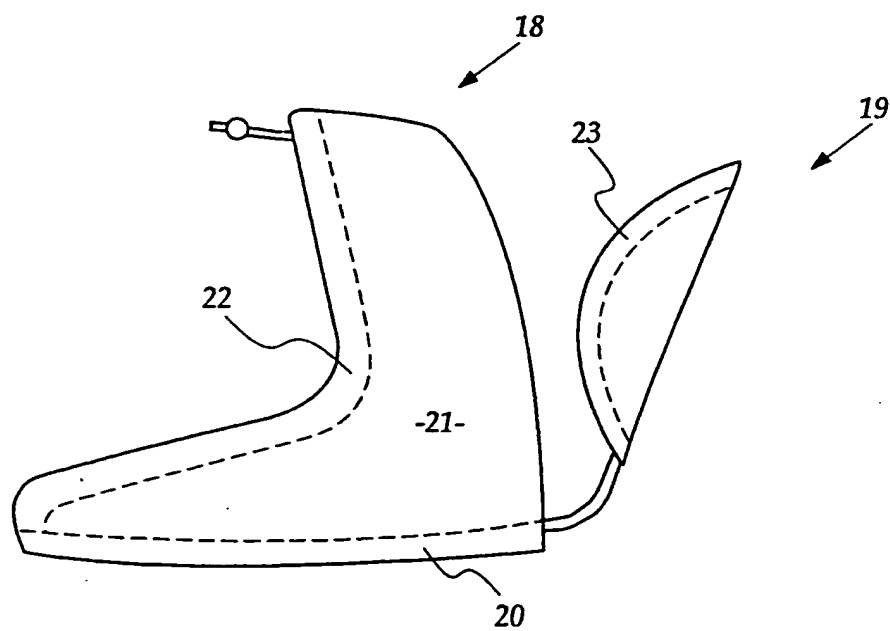


Figure 5.

SUBSTITUTE SHEET

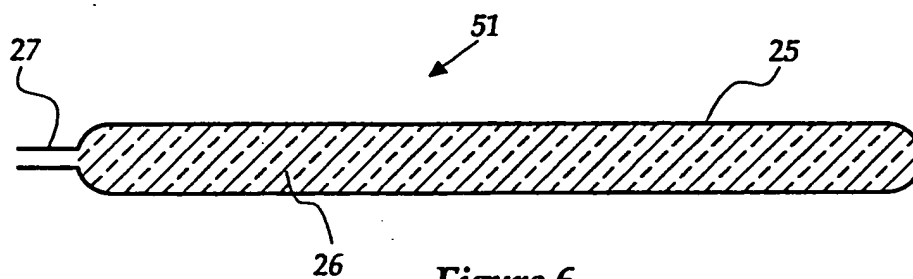


Figure 6.



Figure 7.

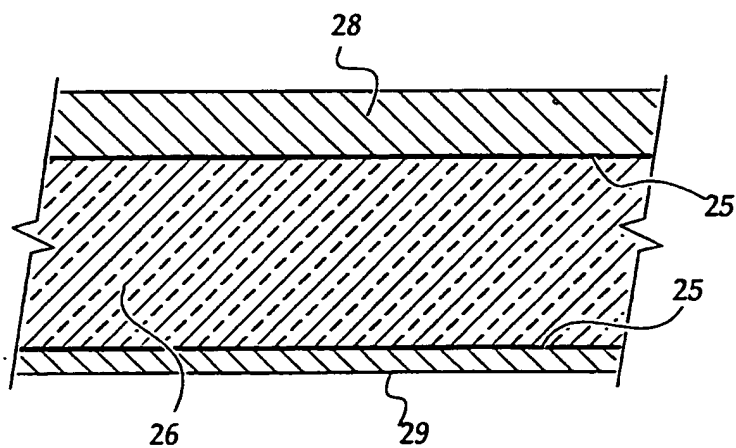


Figure 8.

5/6

Figure 10.

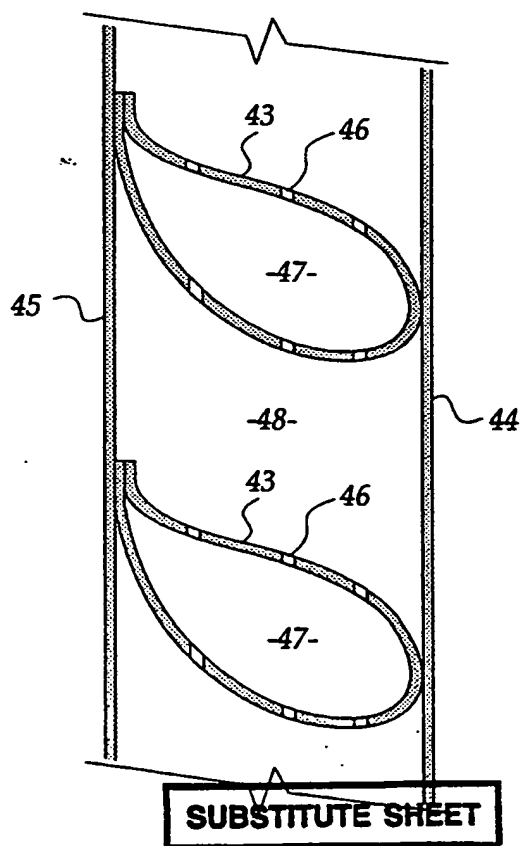
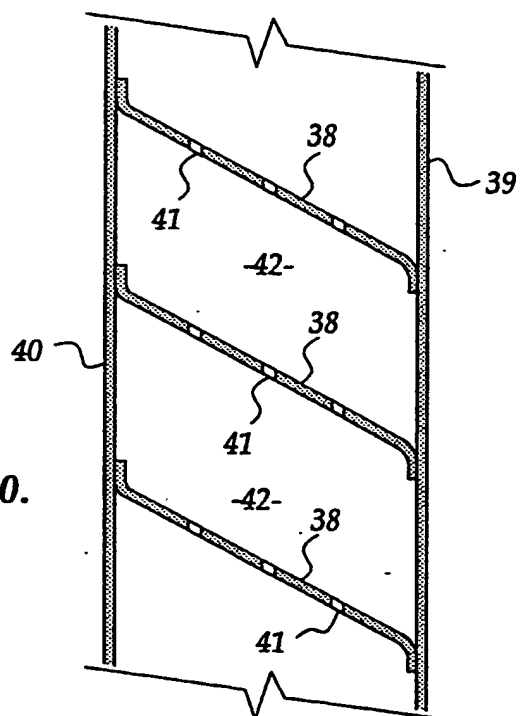


Figure 11.

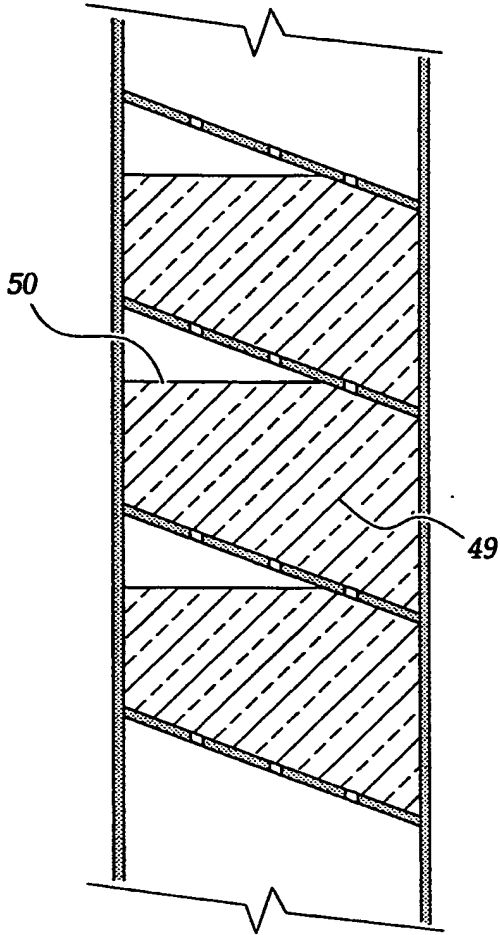


Figure 12.

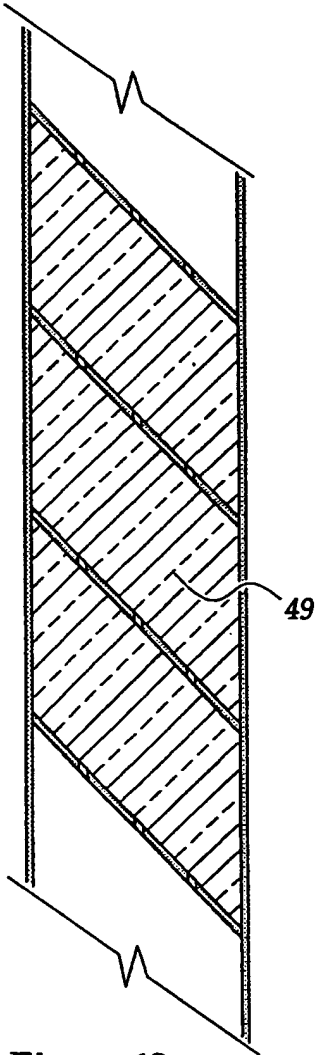



Figure 13.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 93/00331

A. CLASSIFICATION OF SUBJECT MATTER Int. Cl. ⁵ A43B 5/04, 23/07 According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC A43B 5/04, 23/07 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU : IPC as above Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.		
X, Y	FR, A, 2597729 (TARDEGLIO) 30 October 1987 (30.10.87) Figure 1	1-22		
Y	EP, A, 0470358 (CORLETTI) 12 February 1992 (12.02.92) Figure 2	1-22		
X Y	DE, A, 3404554 (KLEIN) 12 July 1984 (12.07.84) Figure Figure	1,2,21,22 3-6,12-19,20		
<div style="display: flex; justify-content: space-between;"> <div style="text-align: left;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. </div> <div style="text-align: left;"> <input checked="" type="checkbox"/> See patent family annex. </div> </div>				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%; vertical-align: top;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p> </td> </tr> </table>			<p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>
<p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>			
Date of the actual completion of the international search 14 October 1993 (14.10.93)		Date of mailing of the international search report 22 OCT 1993 (22.10.93)		
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No. 06 2853929		Authorized officer  PETER WARD Telephone No. (06) 2832126		

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X Y	US,A, 4083127 (HANSON) 11 April 1978 (11.04.78) Figure 2, Col 6 lines 10-21 Figure 2	1,20 2-6,12-19,21,22
Y	EP,A, 221808 (PORCHER) 13 May 1987 (13.05.87) Figure 1	1-6,12-22
X Y	US,A, 4724627 (SISCO) 16 February 1988 (16.02.88) Figures 1,2,5, Col 2, line 28 - Col 3, line 32	1-13,20-22 14-19
Y	US,A, 4654986 (GEORGE) 7 April 1987 (07.04.87) Figure 3, Claims 1-10	1-6,12-22
X Y	DE,A, 1815853 (ROSEMOUNT ENGINEERING COMPANY) 31 July 1969 (31.07.69) Figures 1-3 Figures 1-3	1,2,20 3-6,12-19,21,22
A	DE,A, 1962632 (HEILI) 16 June 1971 (16.06.71)	1-22

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
EP	470358	JP	4242601	US	5184411
EP	221808	FR	2588452	US	4702022
US	4654986	CA	1265333	EP	232163
		JP	62249601		
DE	1815853	CH	516919	FR	1601827
END OF ANNEX					